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NATIONAL DAM SAFETY PROGRAM. GLEN LEONARD DAM (MO 30428), MISSI--ETC(U)
SEP 78

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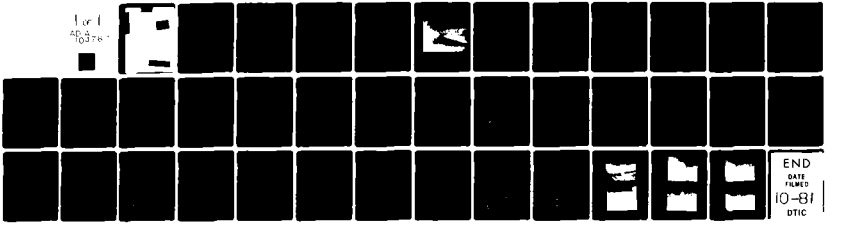

LEVEL II

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A104	3. RECIPIENT'S CATALOG NUMBER 767
4. TITLE (and Subtitle) Phase I Dam Inspection Report National Dam Safety Program Glen Leonard Dam (MO 30428) Jefferson County, Missouri		5. TYPE OF REPORT & PERIOD COVERED Final Report
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Corps of Engineers, St. Louis District		8. CONTRACT OR GRANT NUMBER(s) N/A
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 12131
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101		12. REPORT DATE September 1978
		13. NUMBER OF PAGES Approximately 35
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

National Dam Safety Program. Glen Leonard Dam (MO 30428), Mississippi - Kaskaskia - St. Louis Basin, Jefferson County, Missouri. Phase I Inspection Report.

Approved for release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

LOWER MISSISSIPPI RIVER BASIN

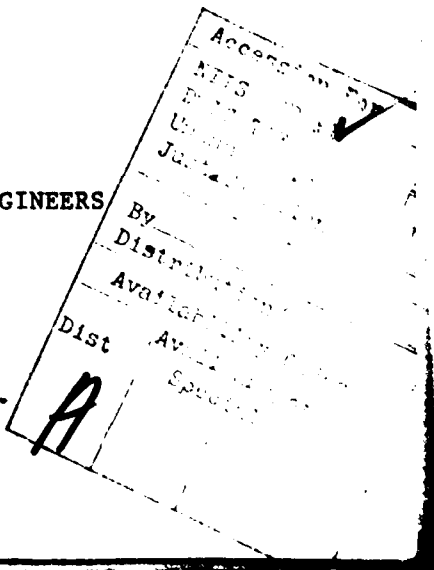
GLEN LEONARD DAM
JEFFERSON COUNTY, MISSOURI

MISSOURI INVENTORY NO. 30428

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY: ST. LOUIS DISTRICT CORPS OF ENGINEERS
FOR: GOVERNOR OF MISSOURI

SEPTEMBER 1978



PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

NAME: Glen Leonard

LOCATION: Jefferson County, Missouri

STREAM: Unnamed Tributary of Heads Creek

DATE OF INSPECTION: 5 September 1978

Glen Leonard Dam (Mo. 30428) was inspected using the "Recommended Guidelines for Safety Inspection of Dams." These guidelines were developed by the Chief of Engineers, U.S. Army, Washington D.C., with the help of Federal and State agencies, professional engineering organizations, and private engineers. The resulting guidelines are considered to represent a consensus of the engineering profession.

Based on the criteria in the guidelines, the dam is in the high hazard potential classification, which means that loss of life and appreciable property loss could occur in the event of failure of the dam. The downstream damage zone is approximately 3 miles long. Over 10 existing homes plus more than 10 additional planned home sites are located within one mile downstream of the dam. These homes and four improved road crossings would be subjected to flooding with possible damage and/or destruction and possible loss of life if the dam should suddenly fail. The dam is in the small size classification because it is less than 40 feet high and impounds less than 1000 acre-feet of water.

For its size and hazard category, this dam is required by the guidelines to pass one-half PMF to the PMF. However, considering the high hazard potential to life (10 existing homes and 10 planned homes) and property downstream of the dam, the PMF is considered the appropriate spillway design flood. The PMF is defined as resulting from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The spillway of this dam will pass only 15 percent of the PMF without overtopping the dam. Our evaluation indicates that the spillway will not pass the 100-year flood, that is a flood having a 1 percent chance of exceedence in any given year, without the dam being overtopped. Since the spillway for Glen Leonard Dam is not capable of passing a minimum of one-half (50 percent) of the PMF without overtopping the dam which may cause failure, the spillway is considered seriously inadequate and the dam is accordingly considered an unsafe, non-emergency structure.

The inspection team observed heavy vegetation covering the dam and spillway. Some trees were 12 to 14 inches in diameter. All areas not covered with trees were overgrown with very heavy brush. The root systems of this vegetation are a potential seepage hazard and constitute a maintenance deficiency. Visual observations were very limited because of the heavy vegetation. Potential exists for other deficiencies such as rodent holes to be found after the trees and brush have been removed.

Seepage and stability analyses are not on record as recommended in the guidelines, which is considered a deficiency that should be rectified.

It is recommended that action be taken by the owner to implement the remedial measures listed herein in the near future. Any corrective works performed in relation to increasing the spillway size and/or dam height and stability, and seepage investigations of the embankment should be made in accordance with analyses and design performed by an engineer experienced in the design of dams. These conclusions were reached by the undersigned inspection team members.

ROBERT MacDONALD
Soils Engineer

RICHARD LEIFIELD
Hydraulic Engineer

MICHAEL CULLEN
Hydraulic Engineer

SUBMITTED BY: _____ 27 Sept 78
Chief, Engineering Division — Date

APPROVED BY: _____ 27 Sep 78
Colonel, CE, District Engineer — Date

OVERVIEW OF GLEN LEONARD DAM AND LAKE

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
GLEN LEONARD DAM

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
GLEN LEONARD DAM ID NO. 30428

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection of the Glen Leonard Dam be made.

b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria. The inspection was accomplished using the "Recommended Guidelines for Safety Inspection of Dams." These guidelines were developed by the Chief of Engineers, U. S. Army, Washington, D. C., with the help of several Federal and State agencies, professional engineering organizations, and private engineers. The resulting guidelines are considered to represent a consensus of the engineering profession.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances.

(1) The dam is an earth structure built in a small valley in the north-east portion of the Missouri Ozark Region. Topography adjacent to the lake is rolling. Topography in the vicinity of the dam is shown on PLATE 2.

(2) The spillway is a non-regulated broad-crested weir located in the left abutment. The approach and exit channels are not well defined because of heavy vegetation growth. (See photographs 2 and 3.)

(3) Pertinent physical data are given in paragraph 1.3 below.

b. Location. The dam is located in the north-east portion of Jefferson County, Missouri, just southwest of Otto, Missouri. The lake formed by the dam is shown on the 1974 revised Belew Creek, Missouri USGS Quadrangle Sheet in the southeast quarter of Section 26, Township 42N, Range 4E (see PLATES 1 and 2).

c. Size Classification. Criteria for determining the size classification of dams and impoundments are presented in Volume 1, Appendix D, Chapter 5, of the National Program of Inspection of Dams Report. Based on these criteria, this dam and impoundment is in the small size classification.

d. Hazard Classification. Criteria for determining hazard classification are presented in the same report as referenced in paragraph c above. Based on referenced criteria, this dam is in the High Hazard Classification. A high hazard dam is one which poses hazards to human life or which would cause extensive property damage should the dam suddenly fail. Over 10 existing homes plus more than 10 additional planned home sites are located within one mile downstream of this dam. These homes and four improved road crossings would be subjected to potential damage and/or destruction and loss of more than a few human lives could result if this dam should suddenly fail. A sudden failure of this dam may cause damage up to three miles downstream.

e. Ownership. This dam is owned by the Colwil Investment Company, Route 2, Highway 21, Arnold, Missouri.

f. Purpose of Dam. The dam forms a 7-acre recreation lake.

g. Design and Construction History. The dam was reportedly constructed in 1956 by Glen and Marvin Leonard. The history available is that which follows as verbally reported by Marvin Leonard. Vegetation was stripped from the foundation area of the dam and a cutoff trench was excavated to bedrock at the centerline of the dam. The bottom of the trench reportedly was 12 to 15 feet wide and the maximum depth was about 12 feet. Clay backfill was placed in the trench. The dam embankment was constructed of random clay gravel material excavated from the lake area. The spillway width was doubled to its present width and the depth was increased one foot during 1957, subsequent to a large rainfall which caused the spillway to flow. Seepage began as soon as the lake was filled. Mr. Leonard estimated the seepage which occurred in 1957 to be equivalent to an 8-inch diameter pipe flowing full, and indicated that the lake dropped to a low level in about three weeks. The seepage surfaced at a point about 300 feet downstream of the right abutment near the road, the same location where seepage still occurs (see paragraph 3.1d). An unsuccessful attempt was made to seal the lake by placing material on the bottom. A core boring was made from

the top of the dam near the old streambed. The driller concluded that the leakage was occurring through a rock strata which was located at a depth of 80 feet. Mr. Leonard indicated that since he and his brother had constructed several small dams in the area, they had not sought engineering assistance to design the dam. No construction plans or documented records are available.

h. Normal Operating Procedure. There are no spillway or outlet structures which can be manually controlled. The normal level of the pool is far below the spillway crest because of seepage which occurs at higher lake levels as described in paragraphs 1.2g.

1.3 PERTINENT DATA

a. Drainage Area - 246 Acres

b. Discharge at Damsite - Unknown - The spillway is the only outlet from the dam. Former owner reports that spillway discharge occurred only once (1957) at which time water was about 2 feet below the top of the dam. The spillway was subsequently enlarged as reported in paragraph 1.2g.

c. Elevation (feet above MSL)

(1) Top of dam - 760.0 ±

(2) Spillway Crest - 756.0 ±

(3) Streambed at toe of dam - 731.0 ±

(4) Maximum tailwater - Unknown

d. Reservoir:

(1) Length of maximum pool - approximately 2300 ± feet.

(2) Length of recreation pool - approximately 1300 ± feet.

e. Reservoir Surface (acres):

(1) Top of dam - 8.0 (reported by owner)
7.4 (topographic quadrangle map)

(2) Spillway crest - 6.5 (topographic quadrangle map)

f. Storage (Acre-feet)

(1) Top of dam - 100 (estimated from map)

(2) Spillway Crest - 75 (estimated from map)

g. Dam.

(1) Type - earth embankment

(2) Length - 560 ± feet

(3) Height - 29 ± feet maximum

(4) Top width - 14 ± feet

(5) Side slopes -

(a) Downstream - 1V on 1.8H (Average)

(b) Upstream - 1V on 2.4H (Average)

(6) Zoning - Description reported by previous owner indicated embankment was not zoned.

(7) Impervious core - Description reported by previous owner indicated impervious core was not constructed.

(8) Cutoff - Reported by previous owner to exist with dimensions of 12 to 15 feet wide and a 12-foot maximum depth to bedrock (see paragraph 1.2g).

(9) Grout curtain - Description reported by previous owner indicated no grout curtain was constructed.

i. Spillway

(1) Type - Uncontrolled (earth channel)

(2) Width of weir - 65 ± feet

(3) Length of weir - approximately 300 feet

(4) Crest elevation - 756.0

j. Regulating Outlets: None

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

No design drawings or calculations are available for this dam. It was built by the previous owner and members of his family.

2.2 CONSTRUCTION

Construction was completed in 1956. No construction records are available.

2.3 OPERATION

No operations because spillway is ungated.

2.4 EVALUATION

a. Availability. The only data readily available is that which could be recalled by the present owner and the description provided by the previous owner (see paragraph 1.2g).

b. Adequacy. Data available were not adequate to make a detailed engineering analysis of the dam. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed and made a matter of record.

c. Validity. No valid engineering design data or construction data were available.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. Glen Leonard Dam was visually inspected by a soils engineer and hydraulics engineers on 5 September 1978. Visual observations of the dam and spillway and the area downstream of the dam were very limited due to the areas being heavily overgrown with vegetation. The owner met the inspection team and discussed briefly some of the history of the construction and performance of the dam. The previous owner was contacted on 12 September 1978 and furnished additional information. Neither owner knew of any stability, or overtopping problems since the dam was first filled in 1956. Observations made by the inspection team are discussed below.

b. Dam. The dam has a narrow crest (14 ± feet) and a height estimated at 29 feet (see PLATES 3 and 4). An embankment cross section is shown on PLATE 4. The slopes indicated are considered typical of the slopes on the entire embankment. The upstream and downstream slopes and spillway and exit channel are heavily covered with trees, brush and grass which would be detrimental to spillway flows. (See photographs 4, 5 and 6.) The spillway channel runs for about 300 feet downstream from the dam on a very small slope, then tapers off into the hills on the left of the old streambed.

No seeps, slides, cracks or detrimental settlement were observed on the dam embankment.

No riprap was observed anywhere on the upstream or downstream slopes of the dam or on the spillway. There was, however, no evidence of erosion to the lake shore or dam embankment.

c. Reservoir Area. No wave wash, excessive erosion, or slides were observed along the shore line.

It appears that the lake regularly fills to about 5-6 feet above the water surface elevation of the lake observed on the day of the field inspection which was approximatey 740.6. This was confirmed by the owner who stated that each spring the water surface rises about 5 or 6 feet with runoff.

d. Downstream Seepage Area. The owner stated that when the water surface rises a few feet above the elevation on the day of the inspection (740.6±), seepage surfaces at a point about 300 feet downstream of the abutment. Hydrophytic growth indicated the probable presence of water consistent with the reported fact that seepage may have occurred at other times.

3.2 EVALUATION

The tree growth on the dam is very extensive and poses a potential seepage problem. The seepage reported by the owner during high water also poses a potential problem as the source and path of the flow is unknown. (See paragraphs 1.2g.)

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

There is no regulation of flow.

4.2 MAINTENANCE OF DAM

As shown on Photos 2 through 6, the entire dam area has not been maintained as evidenced by the heavy brush and tree growth.

4.3 MAINTENANCE OF OPERATING FACILITIES

None

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

No warning system is known to exist.

4.5 EVALUATION

Maintenance and Operation of existing facilities were inadequate at the time of this inspection.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. No design data were made available to the inspection team. The present owner bought the property after the lake was built, and he did not have any design data. The previous owners indicated engineering assistance was not sought to design the dam.

b. Experience Data. All of the pertinent data furnished in this report are based on computations derived from either a U.S. Geological Survey 7-1/2 minute quadrangle sheet (Belew Creek, Missouri) or measurements and surveys made during the field inspection.

c. Visual Observations. It appears that the lake regularly fills to about 5-6 feet above the water surface elevation of the lake observed on the day of the field inspection which was 740.6 ±. This was later confirmed by the owner who stated that each spring the water surface rises about 5 or 6 feet with runoff. The spillway exit channel at the left of the dam is not well defined. This spillway channel runs for about 300 feet downstream from the dam on a very small slope then tapers off into the hills on the left of the old streambed. The channel and channel entrance are not well maintained, being overgrown with thick vegetation and trees.

d. Overtopping Potential. The spillway cannot pass the Probable Maximum Flood (PMF) without overtopping the dam. The 1 percent flood would also overtop the dam. The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The spillway will pass approximately 15 percent of the PMF without overtopping. For the PMF and the one-half PMF, the dam would be overtopped 1.8 feet and 0.9 feet for 5.7 hours and 0.9 hours with a discharge of 4600 cfs and 2300 cfs, respectively.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations. Visual observations of the dam and spillway are discussed and evaluated in Sections 3 and 5. The dam has no other appurtenant structures.

b. Design and Construction Data. No detailed design or construction data are available. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed and made a matter of record.

c. Operating Records. No operating records are available.

d. Post Construction Changes. A waterline was buried on the downstream side of the crest of the dam. Backfill around the pipe has settled unevenly. According to the previous owner the spillway was enlarged to its present size in 1957 as reported in paragraph 1.2g.

e. Seismic Stability. Glen Leonard Dam is in Seismic Zone 2, for which the recommended guidelines assign a "moderate" damage probability. The relatively low height and the type of material of which the dam was constructed minimize the likelihood of failure due to earthquake shock.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. The spillway cannot pass the Probable Maximum Flood without overtopping the dam. For its size and hazard category, this dam is required by the guidelines to pass from one-half PMF to the PMF. Considering the downstream hazard of 10 inhabited homes and 10 additionally planned homes, the spillway size and/or height of the dam should be increased to pass the PMF without overtopping the dam. Overtopping of the dam would be detrimental to the structural integrity of the dam. The major deficiencies observed were vegetation on the dam and spillway and the absence of an exit channel designed to adequately pass at least the PMF. Also, the backfill for the waterline crossing the dam has settled unevenly leaving ruts in the crest of the dam. Since the spillway for Glen Leonard Dam is not capable of passing a minimum of one-half (50 percent) of the PMF without overtopping the dam and causing failure, the spillway is considered seriously inadequate and the dam is accordingly considered unsafe.

b. Adequacy of Information. Due to the lack of engineering design and construction data, the conclusions in this report were based on performance history and limited visual observations. Guidelines furnished for inspection of dams require that seepage and stability analyses be on file for each dam inspected. No such data are available for this dam. This is considered a deficiency which should be corrected.

c. Urgency. It is recommended that the remedial measures listed in Section 7.2 be accomplished in the near future. The item recommended in paragraph 7.2a should be pursued on a high-priority basis.

d. Necessity for Phase II. No Phase II inspection is required.

e. Seismic Stability. Glen Leonard Dam is in Seismic Zone 2, for which the recommended guidelines assign a "moderate" damage probability. The relatively low height and the type of material of which the dam was constructed minimize the likelihood of failure due to earthquake shock.

7.2 REMEDIAL MEASURES

a. Alterations. Spillway size and/or dam height should be increased to pass the Probable Maximum Flood without overtopping.

b. O&M Maintenance and Procedures. The following O&M maintenance procedures are recommended:

(1) Remove all trees and bushes growing on the embankments of the dam and in the spillway approach and exit channels. Potential exists for other deficiencies such as rodent holes to be found after the trees and brush have been removed. Establish a grass or ground cover in those areas after the trees and brush have been removed and any rodent holes found have been filled.

(2) Level the dam crest along the waterline traverse and in the small ditch traverse to the dam axis at approximately station 0+25 as shown on PLATE 3 and establish a grass cover.

c. Seepage and stability analyses should be performed by a professional engineer experienced in the design and construction of dams.

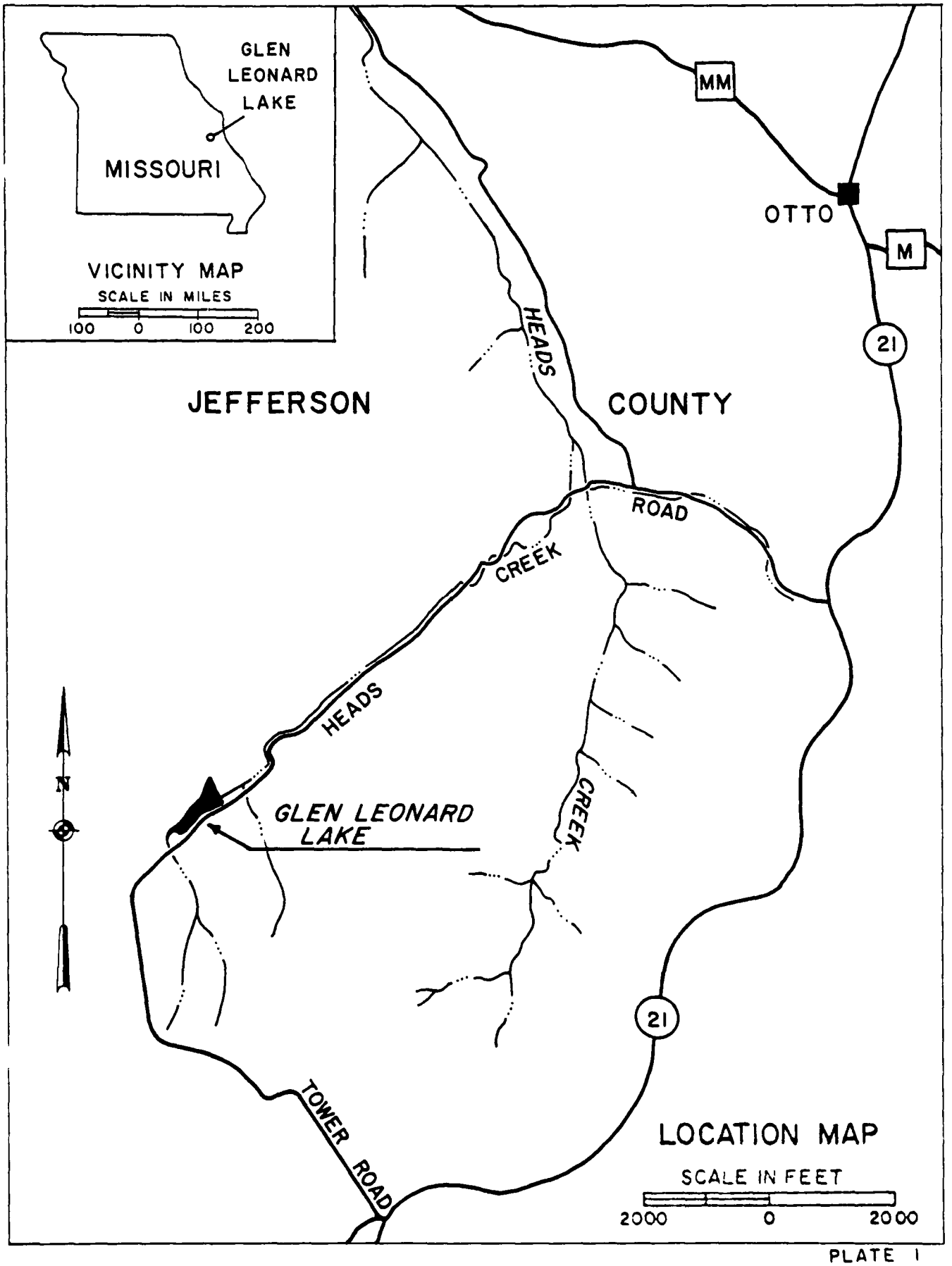
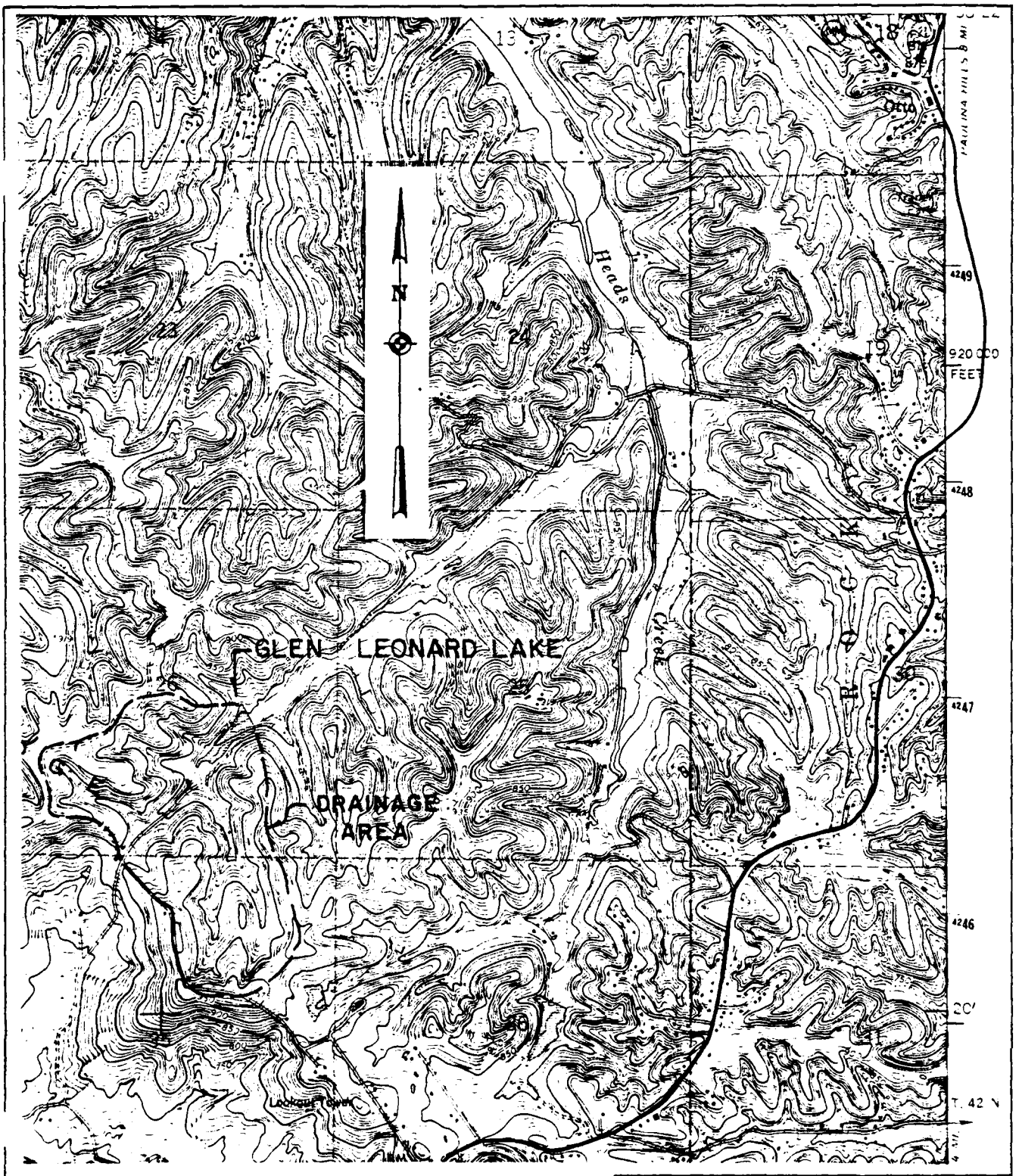

GLEN
LEONARD
LAKE
MISSOURI
VICINITY MAP
SCALE IN MILES
100 0 100 200
MM
OTTO
M
21
HEADS
JEFFERSON
COUNTY
ROAD
CREEK
HEADS
N
GLEN LEONARD
LAKE
CREEK
21
TOWER ROAD
LOCATION MAP
SCALE IN FEET
2000 0 2000

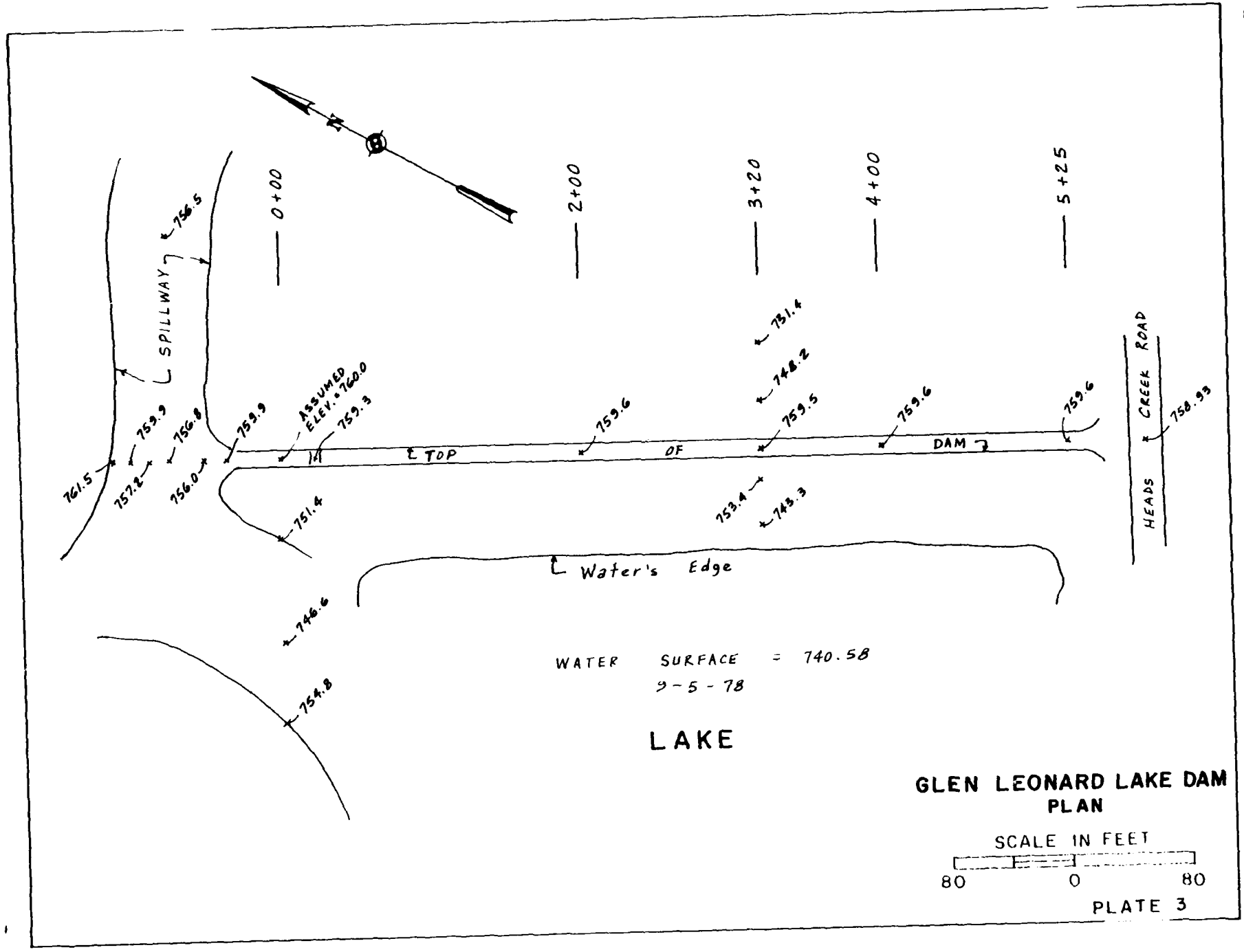
PLATE 1



GLEN LEONARD LAKE

VICINITY TOPOGRAPHY

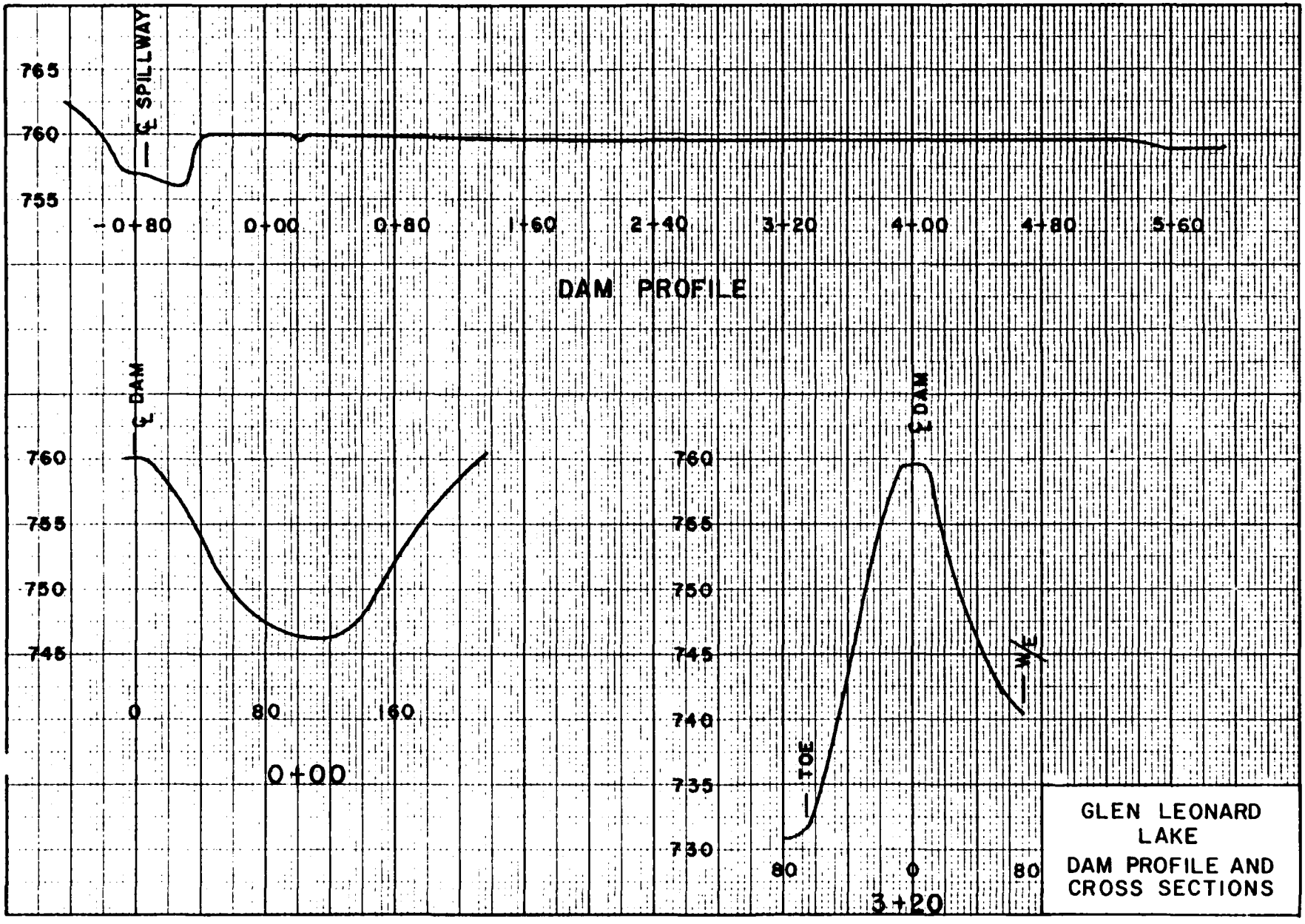
PLATE 2



GLEN LEONARD LAKE DAM
PLAN

SCALE IN FEET
80 0 80

PLATE 3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760
755
℄ SPILLWAY
-0+80
0+00
0+80
1+60
2+40
3+20
4+00
4+80
5+60
DAM PROFILE
℄ DAM
760
755
750
745
0
80
160
0+00
760
755
750
745
740
735
730
TOE
℄ DAM
℄
80
0
80
3+20
GLEN LEONARD
LAKE
DAM PROFILE AND
CROSS SECTIONS

PLATE 4

APPENDIX

HYDROLOGIC COMPUTATIONS

HYDROLOGIC AND HYDRAULIC ANALYSIS METHODOLOGY

1. The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for a reservoir routing. The Probable Maximum Precipitation for those dams in the high hazard potential category is derived and determined from regional charts prepared by the National Weather Service in "Hydrometeorological Report No. 33." Reduction factors have not been applied. A 24-hour storm duration is assumed with the 24-hour rainfall depths distributed over 6-hour periods in accordance with procedures outlined in EM 1110-2-1411 (SPF Determination). The maximum 6-hour rainfall period is then distributed to hourly increments by the same criteria. Within-the-hour distribution is based upon NOAA Technical Memorandum NWS HYDRO-35. The non-peak 6-hour rainfall periods are distributed uniformly. All distributed values are arranged in a critical sequence by the SPF criteria. The final inflow hydrograph is produced by deduction of infiltration losses appropriate to the soil, land use, and antecedent moisture conditions according to the SCS hydrograph computation procedure.

2. The reservoir routing is accomplished by using Modified Puls routing techniques wherein the flood hydrograph is routed through lake storage. Hydraulic capacities of the spillway, and crest of dam are used as outlet controls in the routing. Storage in the pool area is defined by an elevation-storage capacity curve. The spillway capacity was determined as described in paragraph 3 below. The hydraulic capacity of the top of dam was calculated using the weir equation.

3. The spillway rating curve was derived from the results of backwater computations through the spillway. Computer program HEC-2, November 1976, prepared by the Hydrologic Engineering Center, U. S. Army Corps of Engineers, Davis, California, was used to compute the water surface elevations for a range of flows through the spillway. The elevation-discharge values at the spillway entrance were used for the spillway rating curve. PLATES A-8 and A-9 show the HEC-2 input and summary printout.

4. Dam overtopping analysis has been conducted by hydrologic methods for this dam and lake. This computation determines the percentage of the PMF hydrograph that the reservoir can contain without the dam being overtopped. An output summary in the hydrologic appendix displays this information as well as other characteristics of the simulated dam overtopping.

5. The above overtopping analysis has been accomplished for this report using the systemized computer program HEC-1 (Dam Safety Version), July 1978, prepared by the Hydrologic Engineering Center, U. S. Army Corps of Engineers, Davis, California. The numeric parameters estimated for this site are listed on PLATE A1. Definitions of these variables are contained in the "User's Manual" for the computer program.

PROJECT		COMPUTED BY	DATE
GLEN LEONARD DAM INSPECTION	Page 1 of 1	D.F.	12 SEPT 7.
SUBJECT		CHECKED BY	DATE
DRAINAGE AND HYDROLOGIC PARAMETERS			

DRAINAGE AREA = 246 ACRES = 3.84 SQ. MI.

ELEV. TOP OF DAM = 759.6 ± FT MSL

SPILLWAY CREST ELEV. = 756.0 ± FT. MSL

DAM WIDTH = 500 FT

ANTECEDENT MOISTURE CONDITION II

SCS CURVE NO 37

Tc = .255 HRS (USING KIRPICH EQUATION)

SPILLWAY RATING CURVE

ELEVATION (MSL)	DISCHARGE (CFS)
757.26	10
758.43	100
759.49	400
759.99	1000
760.77	2000
762.10	4000
763.59	6000

LAKE AREA-ELEV CURVE

AREA (ACRES)	ELEV (MSL)
3.0	740
5.2	750
7.4	760

WEIR COEFFICIENT AT DAM

C = 2.5

PLATE A1

```
1**********
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION      JULY 1978
   LAST MODIFICATION   18 SEP 78
 **********
     1                 A1       GLEN LEONARD LAKE - MULTI-RATIO OF PMF FLOOD ANALYSIS
     2                 A2       FOR THE NATIONAL DAM INSPECTION PROGRAM.  INVENTORY NUMBER 30428.
     3                 A3       BY RICHARD LEIFIELD - ST. LOUIS DISTRICT - SEPT 78
     4                 B     288        0        5        0        0        0        0        0       -5        0
     5                 B1      5
     6                 J       1        2        1
     7                 J1  0.10     0.15     0.20     0.25     0.30     0.40     0.50     1.00
     8                 K                1                          3        1
     9                 K1       INFLOW HYDROGRAPH COMPUTATION
    10                 M        1        2     .384                 1                          1
    11                 P                25      102      120      130
    12                 T                                                          -1      -87             .001
    13                 U2            .163
    14                 X             -.10      3.0
    15                 K        1    30428                        2        3        1
    16                 K1       RESEVOIR ROUTING BY MODIFIED PULS
    17                 Y                                     1        1
    18                 Y1       1                                                -756.0       -1
    19                 Y4757.28  758.43   759.48   759.99   765.77   769.18   781.58
    20                 YS       10      100      400     1000     2000     4000     6000
    21                 SA     3.0      5.2      7.4
    22                 SE     740      750      760
    23                 SS   756.0
    24                 SD   759.6      2.5      1.5      560
    25                 K        99
E>
```

PLATE A-2

```
1**********************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION      JULY 1978
   LAST MODIFICATION  12 SEP 78
**********************************

 RUN  DATE= 78/09/15.
      TIME= 08.41.38.


                    GLEN LEONARD LAKE - MULTI-RATIO OF PMF FLOOD ANALYSIS
                    FOR THE NATIONAL DAM INSPECTION PROGRAM.  INVENTORY NUMBER 30428.
                    BY RICHARD LEIFIELD - ST. LOUIS DISTRICT - SEPT 78

                                        JOB SPECIFICATION
                      NQ      NHR     NMIN     IDAY     IHR     IMIN    METRC     IPLT     IPRT    NSTAN
                     288        0        5        0        0        0        0        0       -5        0
                                                JOPER      NWT   LROPT    TRACE
                                                    5        0        0        0


          **********          **********          **********          **********          **********

                                    SUB-AREA RUNOFF COMPUTATION

                    INFLOW HYDROGRAPH COMPUTATION

                                ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                                    1       0       0       0       0       3       1       0       0

                                            HYDROGRAPH DATA
                      IHYDG    IUNG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
                          1       2     .38    0.00     .38    1.00   0.000       0       1       0

                                            PRECIP DATA
                             SPFE     PMS      R6     R12     R24     R48     R72     R96
                             0.00   85.00  102.00  120.00  130.00    0.00    0.00    0.00

                                            LOSS DATA
                    LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
                        0    0.00    0.00    1.00    0.00    0.00    1.00   -1.00  -87.00    0.00     .00

                    CURVE NO =  -87.00  WETNESS =   -1.00  EFFECT CN =   87.00

                                        UNIT HYDROGRAPH DATA
                                    TC=  0.00    LAG=   .15

                                        RECESSION DATA
                                STRTQ=    0.00    QRCSN=   -.10    RTIOR= 3.00

                    TIME INCREMENT TOO LARGE--(NNQ IS GT LAG/2)

                    UNIT HYDROGRAPH 11 END OF PERIOD ORDINATES, TC=    0.00 HOURS, LAG=    .15  VOL= 1.00
                      341.     987.     838.     434.     220.     108.      53.      27.      13.       7.
                        3.
E>
```

PLATE A-3

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	END-OF-PERIOD FLOW COMP Q
1.01	.05	1	.01	.00	.01	0.
1.01	.10	2	.01	.00	.01	0.
1.01	.15	3	.01	.00	.01	0.
1.01	.20	4	.01	.00	.01	0.
1.01	.25	5	.01	.00	.01	0.
1.01	.30	6	.01	.00	.01	0.
1.01	.35	7	.01	.00	.01	0.
1.01	.40	8	.01	.00	.01	0.
1.01	.45	9	.01	.00	.01	0.
1.01	.50	10	.01	.00	.01	0.
1.01	.55	11	.01	.00	.01	0.
1.01	1.00	12	.01	.00	.01	0.
1.01	1.05	13	.01	.00	.01	0.
1.01	1.10	14	.01	.00	.01	0.
1.01	1.15	15	.01	.00	.01	0.
1.01	1.20	16	.01	.00	.01	0.
1.01	1.25	17	.01	.00	.01	0.
1.01	1.30	18	.01	.00	.01	0.
1.01	1.35	19	.01	.00	.01	0.
1.01	1.40	20	.01	.00	.01	0.
1.01	1.45	21	.01	.00	.01	0.
1.01	1.50	22	.01	.00	.01	0.
1.01	1.55	23	.01	.00	.01	0.
1.01	2.00	24	.01	.00	.01	0.
1.01	2.05	25	.01	.00	.01	1.
1.01	2.10	26	.01	.00	.01	2.
1.01	2.15	27	.01	.00	.01	2.
1.01	2.20	28	.01	.00	.01	3.
1.01	2.25	29	.01	.00	.01	4.
1.01	2.30	30	.01	.00	.01	4.
1.01	2.35	31	.01	.00	.01	5.
1.01	2.40	32	.01	.00	.01	6.
1.01	2.45	33	.01	.00	.01	6.
1.01	2.50	34	.01	.00	.01	7.
1.01	2.55	35	.01	.00	.01	7.
1.01	3.00	36	.01	.00	.01	8.
1.01	3.05	37	.01	.00	.01	8.
1.01	3.10	38	.01	.00	.01	9.
1.01	3.15	39	.01	.00	.01	9.
1.01	3.20	40	.01	.00	.01	10.
1.01	3.25	41	.01	.00	.01	10.
1.01	3.30	42	.01	.00	.01	11.
1.01	3.35	43	.01	.00	.01	11.
1.01	3.40	44	.01	.00	.01	12.
1.01	3.45	45	.01	.00	.01	12.
1.01	3.50	46	.01	.00	.01	13.
1.01	3.55	47	.01	.00	.01	13.
1.01	4.00	48	.01	.00	.01	14.
1.01	4.05	49	.01	.01	.01	14.
1.01	4.10	50	.01	.01	.01	15.
1.01	4.15	51	.01	.01	.01	15.
1.01	4.20	52	.01	.01	.01	16.
1.01	4.25	53	.01	.01	.01	16.
1.01	4.30	54	.01	.01	.01	16.
1.01	4.35	55	.01	.01	.01	16.
1.01	4.40	56	.01	.01	.01	17.
1.01	4.45	57	.01	.01	.01	17.

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	18.05	145	.21	.20	.01	885.
1.01	18.10	146	.21	.20	.01	358.
1.01	18.15	147	.21	.20	.01	478.
1.01	18.20	148	.21	.20	.01	541.
1.01	18.25	149	.21	.20	.01	574.
1.01	18.30	150	.21	.20	.01	591.
1.01	18.35	151	.21	.21	.01	600.
1.01	18.40	152	.21	.21	.01	605.
1.01	18.45	153	.21	.21	.01	608.
1.01	18.50	154	.21	.21	.01	611.
1.01	18.55	155	.21	.21	.01	612.
1.01	19.00	156	.21	.21	.01	613.
1.01	19.05	157	.26	.25	.01	628.
1.01	19.10	158	.26	.25	.01	667.
1.01	19.15	159	.26	.25	.01	703.
1.01	19.20	160	.26	.25	.01	722.
1.01	19.25	161	.26	.25	.01	732.
1.01	19.30	162	.26	.25	.01	737.
1.01	19.35	163	.26	.25	.00	740.
1.01	19.40	164	.26	.25	.00	742.
1.01	19.45	165	.26	.25	.00	743.
1.01	19.50	166	.26	.25	.00	744.
1.01	19.55	167	.26	.25	.00	745.
1.01	14.00	168	.28	.25	.00	745.
1.01	14.05	169	.32	.31	.00	767.
1.01	14.10	170	.32	.31	.00	826.
1.01	14.15	171	.32	.31	.00	879.
1.01	14.20	172	.32	.31	.00	907.
1.01	14.25	173	.32	.31	.00	922.
1.01	14.30	174	.32	.32	.00	929.
1.01	14.35	175	.32	.32	.00	933.
1.01	14.40	176	.32	.32	.00	935.
1.01	14.45	177	.32	.32	.00	936.
1.01	14.50	178	.32	.32	.00	937.
1.01	14.55	179	.32	.32	.00	938.
1.01	15.00	180	.32	.32	.00	938.
1.01	15.05	181	.19	.19	.00	896.
1.01	15.10	182	.39	.38	.00	848.
1.01	15.15	183	.39	.38	.00	922.
1.01	15.20	184	.68	.68	.00	1085.
1.01	15.25	185	.68	.67	.00	1363.
1.01	15.30	186	1.85	1.64	.01	1972.
1.01	15.35	187	2.71	2.70	.01	3406.
1.01	15.40	188	1.07	1.06	.00	4730.
1.01	15.45	189	.68	.68	.00	4434.
1.01	15.50	190	.68	.68	.00	3367.
1.01	15.55	191	.39	.39	.00	2687.
1.01	16.00	192	.39	.39	.00	1813.
1.01	16.05	193	.39	.39	.00	1601.
1.01	16.10	194	.39	.39	.00	1288.
1.01	16.15	195	.39	.39	.00	1065.
1.01	16.20	196	.39	.39	.00	948.
1.01	16.25	197	.39	.39	.00	891.
1.01	16.30	198	.39	.39	.00	897.
1.01	16.35	199	.39	.39	.00	888.
1.01	16.40	200	.39	.39	.00	884.
1.01	16.45	201	.39	.39	.00	883.

PLATE A-4

1.01	4.80	98	.01	.01	.01	17.	1.01	16.80	208	.30	.30	.00	888.
1.01	4.85	99	.01	.01	.01	18.	1.01	16.85	203	.30	.30	.00	888.
1.01	4.90	100	.01	.01	.01	18.	1.01	17.00	204	.30	.30	.00	888.
1.01	4.95	101	.01	.01	.01	18.	1.01	17.05	205	.03	.03	.00	860.
1.01	5.10	102	.01	.01	.01	19.	1.01	17.10	206	.03	.03	.00	801.
1.01	5.15	103	.01	.01	.01	19.	1.01	17.15	207	.03	.03	.00	748.
1.01	5.20	104	.01	.01	.01	19.	1.01	17.20	208	.03	.03	.00	720.
1.01	5.25	105	.01	.01	.01	20.	1.01	17.25	209	.03	.03	.00	707.
1.01	5.30	106	.01	.01	.01	20.	1.01	17.30	210	.03	.03	.00	700.
1.01	5.35	107	.01	.01	.01	20.	1.01	17.35	211	.03	.03	.00	698.
1.01	5.40	108	.01	.01	.01	20.	1.01	17.40	212	.03	.03	.00	695.
1.01	5.45	109	.01	.01	.01	21.	1.01	17.45	213	.03	.03	.00	694.
1.01	5.50	70	.01	.01	.01	21.	1.01	17.50	214	.03	.03	.00	693.
1.01	5.55	71	.01	.01	.01	21.	1.01	17.55	215	.03	.03	.00	693.
1.01	6.00	72	.01	.01	.01	22.	1.01	18.00	216	.03	.03	.00	693.
1.01	6.05	73	.06	.03	.03	31.	1.01	18.05	217	.02	.02	.00	621.
1.01	6.10	74	.06	.04	.03	57.	1.01	18.10	218	.02	.02	.00	461.
1.01	6.15	75	.06	.04	.03	81.	1.01	18.15	219	.02	.02	.00	413.
1.01	6.20	76	.06	.04	.02	96.	1.01	18.20	220	.02	.02	.00	370.
1.01	6.25	77	.06	.04	.02	105.	1.01	18.25	221	.02	.02	.00	331.
1.01	6.30	78	.06	.04	.02	118.	1.01	18.30	222	.02	.02	.00	297.
1.01	6.35	79	.06	.04	.02	117.	1.01	18.35	223	.02	.02	.00	266.
1.01	6.40	80	.06	.04	.02	181.	1.01	18.40	224	.02	.02	.00	238.
1.01	6.45	81	.06	.04	.02	124.	1.01	18.45	225	.02	.02	.00	214.
1.01	6.50	82	.06	.04	.02	187.	1.01	18.50	226	.02	.02	.00	191.
1.01	6.55	83	.06	.05	.02	130.	1.01	18.55	227	.02	.02	.00	171.
1.01	7.00	84	.06	.05	.02	132.	1.01	19.00	228	.02	.02	.00	154.
1.01	7.05	85	.06	.05	.02	135.	1.01	19.05	229	.02	.02	.00	138.
1.01	7.10	86	.06	.05	.02	137.	1.01	19.10	230	.02	.02	.00	123.
1.01	7.15	87	.06	.05	.01	139.	1.01	19.15	231	.02	.02	.00	110.
1.01	7.20	88	.06	.05	.01	141.	1.01	19.20	232	.02	.02	.00	99.
1.01	7.25	89	.06	.05	.01	142.	1.01	19.25	233	.02	.02	.00	89.
1.01	7.30	90	.06	.05	.01	144.	1.01	19.30	234	.02	.02	.00	79.
1.01	7.35	91	.06	.05	.01	146.	1.01	19.35	235	.02	.02	.00	71.
1.01	7.40	92	.06	.05	.01	147.	1.01	19.40	236	.02	.02	.00	64.
1.01	7.45	93	.06	.05	.01	149.	1.01	19.45	237	.02	.02	.00	62.
1.01	7.50	94	.06	.05	.01	150.	1.01	19.50	238	.02	.02	.00	62.
1.01	7.55	95	.06	.05	.01	151.	1.01	19.55	239	.02	.02	.00	62.
1.01	8.00	96	.06	.05	.01	153.	1.01	20.00	240	.02	.02	.00	62.
1.01	8.05	97	.06	.05	.01	154.	1.01	20.05	241	.02	.02	.00	62.
1.01	8.10	98	.06	.05	.01	155.	1.01	20.10	242	.02	.02	.00	62.
1.01	8.15	99	.06	.05	.01	156.	1.01	20.15	243	.02	.02	.00	62.
1.01	8.20	100	.06	.05	.01	157.	1.01	20.20	244	.02	.02	.00	62.
1.01	8.25	101	.06	.05	.01	158.	1.01	20.25	245	.02	.02	.00	62.
1.01	8.30	102	.06	.05	.01	159.	1.01	20.30	246	.02	.02	.00	62.
1.01	8.35	103	.06	.05	.01	159.	1.01	20.35	247	.02	.02	.00	62.
1.01	8.40	104	.06	.05	.01	160.	1.01	20.40	248	.02	.02	.00	62.
1.01	8.45	105	.06	.05	.01	161.	1.01	20.45	249	.02	.02	.00	62.
1.01	8.50	106	.06	.05	.01	162.	1.01	20.50	250	.02	.02	.00	62.
1.01	8.55	107	.06	.05	.01	163.	1.01	20.55	251	.02	.02	.00	62.
1.01	9.00	108	.06	.05	.01	163.	1.01	21.00	252	.02	.02	.00	62.
1.01	9.05	109	.06	.05	.01	164.	1.01	21.05	253	.02	.02	.00	62.
1.01	9.10	110	.06	.05	.01	164.	1.01	21.10	254	.02	.02	.00	62.
1.01	9.15	111	.06	.05	.01	165.	1.01	21.15	255	.02	.02	.00	62.
1.01	9.20	112	.06	.05	.01	166.	1.01	21.20	256	.02	.02	.00	62.
1.01	9.25	113	.06	.05	.01	166.	1.01	21.25	257	.02	.02	.00	62.
1.01	9.30	114	.06	.05	.01	167.	1.01	21.30	258	.02	.02	.00	62.
1.01	9.35	115	.06	.05	.01	167.	1.01	21.35	259	.02	.02	.00	62.
1.01	9.40	116	.06	.05	.01	168.	1.01	21.40	260	.02	.02	.00	62.
1.01	9.45	117	.06	.05	.01	168.	1.01	21.45	261	.02	.02	.00	62.

PLATE A-5

1.01	9.00	118	.06	.08	.01	169.	1.01	21.50	262	.02	.02	.00	62.
1.01	9.05	119	.06	.08	.01	169.	1.01	21.55	263	.02	.02	.00	62.
1.01	9.10	120	.06	.08	.01	169.	1.01	22.00	264	.02	.02	.00	62.
1.01	9.15	121	.06	.08	.01	170.	1.01	22.05	265	.02	.02	.00	62.
1.01	9.20	122	.06	.08	.00	170.	1.01	22.10	266	.02	.02	.00	62.
1.01	9.25	123	.06	.08	.00	171.	1.01	22.15	267	.02	.02	.00	62.
1.01	9.30	124	.06	.08	.00	171.	1.01	22.20	268	.02	.02	.00	62.
1.01	9.35	125	.06	.08	.00	171.	1.01	22.25	269	.02	.02	.00	62.
1.01	9.40	126	.06	.06	.00	172.	1.01	22.30	270	.02	.02	.00	62.
1.01	9.45	127	.06	.06	.00	172.	1.01	22.35	271	.02	.02	.00	62.
1.01	9.50	128	.06	.06	.00	172.	1.01	22.40	272	.02	.02	.00	62.
1.01	9.55	129	.06	.06	.00	173.	1.01	22.45	273	.02	.02	.00	62.
1.01	10.00	130	.06	.06	.00	173.	1.01	22.50	274	.02	.02	.00	62.
1.01	10.05	131	.06	.06	.00	173.	1.01	22.55	275	.02	.02	.00	62.
1.01	10.10	132	.06	.06	.00	173.	1.01	23.00	276	.02	.02	.00	62.
1.01	10.15	133	.06	.06	.00	174.	1.01	23.05	277	.02	.02	.00	62.
1.01	10.20	134	.06	.06	.00	174.	1.01	23.10	278	.02	.02	.00	62.
1.01	10.25	135	.06	.06	.00	174.	1.01	23.15	279	.02	.02	.00	62.
1.01	10.30	136	.06	.06	.00	174.	1.01	23.20	280	.02	.02	.00	62.
1.01	10.35	137	.06	.06	.00	175.	1.01	23.25	281	.02	.02	.00	62.
1.01	10.40	138	.06	.06	.00	175.	1.01	23.30	282	.02	.02	.00	62.
1.01	10.45	139	.06	.06	.00	176.	1.01	23.35	283	.02	.02	.00	62.
1.01	10.50	140	.06	.06	.00	176.	1.01	23.40	284	.02	.02	.00	62.
1.01	10.55	141	.06	.06	.00	175.	1.01	23.45	285	.02	.02	.00	62.
1.01	11.00	142	.06	.06	.00	176.	1.01	23.50	286	.02	.02	.00	62.
1.01	11.05	143	.06	.06	.00	176.	1.01	23.55	287	.02	.02	.00	62.
1.01	11.10	144	.06	.06	.00	176.	1.02	0.00	288	.02	.02	.00	62.
									SUM	38.50	30.77	1.73	93334.
										(826.)	(782.)	(44.)	(2642.92)

PLATE A-6

SUMMARY OF DAM SAFETY ANALYSIS

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	756.00	756.00	759.60
STORAGE	75.	75.	100.
OUTFLOW	10.	10.	532.

RATIO OF PMF	MAXIMUM RESERVOIR U.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	759.06	0.00	96.	279.	0.00	15.92	0.00
.15	759.61	.01	100.	540.	.08	15.83	0.00
.20	759.79	.19	102.	866.	.25	15.75	0.00
.25	759.91	.31	103.	1152.	.42	15.75	0.00
.30	760.01	.41	103.	1376.	.58	15.75	0.00
.40	760.17	.57	105.	1818.	.75	15.75	0.00
.50	760.50	.90	107.	2283.	.92	15.75	0.00
1.00	761.40	1.80	114.	4636.	5.67	15.75	0.00

D

PLATE A-7

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**********************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED  AUG1977
  ERROR CODE -  61,62
  MODIFICATION -  50,51,52,53
**********************************************************

T1   GLEN LEONARD SPILLWAY
T2
T3

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ
      0.       2.        0.        0. -1.000000      0.00      0.0       0.     0.000     0.000
J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE
     1.000     0.000    -1.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000
J3  VARIABLE CODES FOR SUMMARY PRINTOUT
    38.000     1.000    43.000    17.000    51.000    25.000    26.000     0.000     0.000     0.000
J5  LPRNT     NUMSEC                      ********REQUESTED SECTION NUMBERS********
    -10.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000
NC      0.000     0.000     0.000      .100      .300     0.000     0.000     0.000     0.000     0.000
NV      4.000      .120   767.000      .080   758.000      .040   759.000      .025   770.000     0.000
GT      5.000    10.000   100.000   400.000  1000.000  2000.000  4000.000  6000.000 10000.000     0.000

X1      1.000     7.000    35.000   100.000     0.000     0.000     0.000     0.000     -.400     0.000
GR    780.000     0.000   759.000    35.000   756.000    50.000   756.000    75.000   757.200    85.000
GR    769.000   100.000   781.000   112.000     0.000     0.000     0.000     0.000     0.000     0.000

X1      5.000     0.000     0.000     0.000   150.000   150.000   150.000     0.000      .200     0.000

X1      3.000     0.000     0.000     0.000   150.000   150.000   150.000     0.000      .200     0.000
NV      4.000      .120   752.000      .080   754.000      .040   756.000      .025   770.000     0.000

X1      4.000     5.000    50.000   175.000   815.000    64.000   152.000     0.000     0.000     0.000
X3     10.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000
GR    780.000     0.000   760.200     5.000   751.400    50.000   746.800   122.000   754.200   175.000
SJ      0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000
E>
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PLATE A-8

SUMMARY PRINTOUT

	SECNO	CUSEL	Q	KtXNCH	DIFUSX	AREA	UCM
*	1.000	756.06	10.00	157.78	0.00	3.64	8.75
*	1.000	754.78	100.00	109.88	0.00	83.30	4.89
*	1.000	757.66	400.00	86.05	0.00	82.05	6.45
*	1.000	758.71	1000.00	51.58	0.00	181.92	8.20
*	1.000	760.85	2000.00	39.61	0.00	156.97	12.74
*	1.000	760.38	4000.00	38.48	0.00	162.74	24.58
*	1.000	760.41	8000.00	38.43	0.00	165.13	36.33
*	1.000	760.43	10000.00	38.41	0.00	166.37	60.11
	2.000	757.06	10.00	118.34	.99	87.14	.37
	2.000	758.16	100.00	73.80	1.48	80.18	1.86
	2.000	758.15	400.00	39.78	1.56	136.69	2.93
*	2.000	760.70	1000.00	39.05	.99	170.50	5.88
*	2.000	763.92	2000.00	33.29	4.64	632.28	.00
	2.000	767.58	4000.00	28.30	8.20	1041.72	.01
	2.000	781.33	8000.00	9.55	21.91	2581.89	.01
	2.000	820.86	10000.00	-44.35	61.42	7009.42	.00
	3.000	757.86	10.00	109.67	.81	87.97	.36
	3.000	758.42	100.00	63.19	.26	83.55	1.20
	3.000	758.40	400.00	39.39	.31	142.30	2.81
*	3.000	758.10	1000.00	39.87	-.60	181.11	2.26
*	3.000	764.84	2000.00	33.13	-.18	682.77	.00
	3.000	767.46	4000.00	28.47	-.12	1005.32	.01
	3.000	781.32	8000.00	9.67	-.01	2558.85	.01
	3.000	820.86	10000.00	-44.35	-.00	6986.90	.00
	4.000	757.86	10.00	38.65	.00	1028.58	.00
	4.000	758.43	100.00	37.39	.01	1212.59	.00
	4.000	758.40	400.00	36.86	.03	1385.44	.00
	4.000	758.69	1000.00	36.64	.59	1419.58	.00
	4.000	765.77	2000.00	29.63	1.73	2478.65	.00
	4.000	769.10	4000.00	25.96	1.65	3061.76	.00
	4.000	781.59	8000.00	18.59	.87	5248.93	.00
	4.000	820.98	10000.00	-29.62	.12	12140.93	.00

E>

PLATE A-9

PHOTO 1 SEEPAGE AREA DOWNSTREAM OF DAM (Seepage Exits in Group of Willows at Left Foreground When Lake Level is Higher)

PHOTO 2 SPILLWAY APPROACH (Looking Toward Spillway From Near Water's Edge. Spillway is at Left Abutment - Upper Right of Photo).

PHOTO 3 SPILLWAY EXIT
(Looking Downstream from Near
Center Line of Dam)

PHOTO 4 UPSTREAM SLOPE OF DAM

PHOTO 5 TOP OF DAM
(Looking From Left Abutment
Toward Right Abutment)

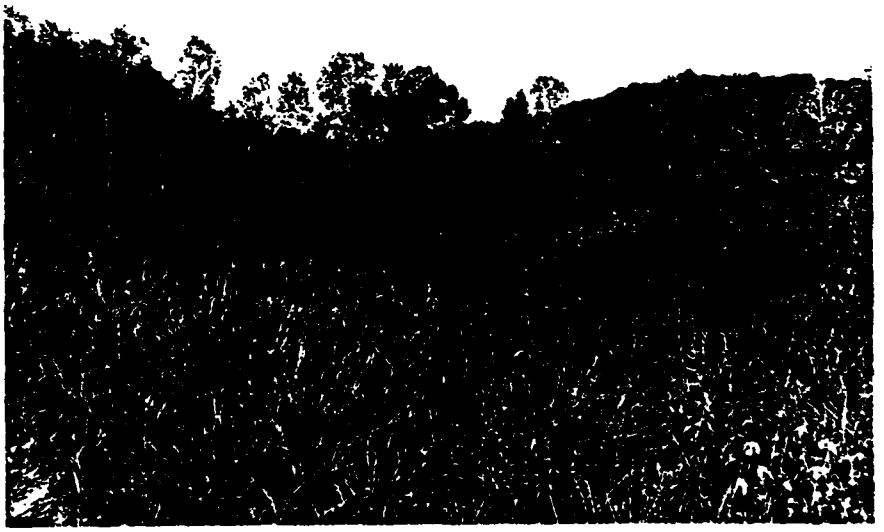
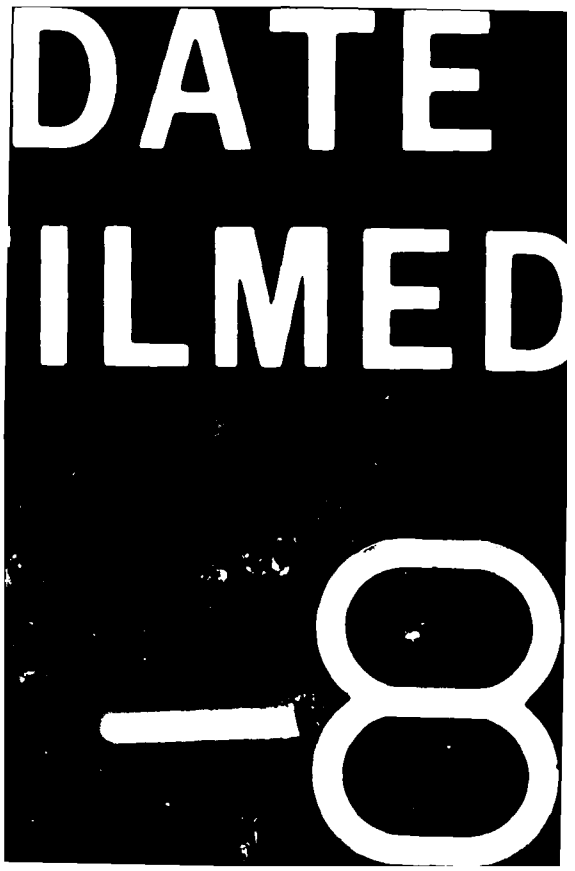


PHOTO 6 DOWNSTREAM FACE OF DAM
(Slope of Embankment Shown
in Area Indicated)


DATE
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-8